

What is claimed is:

[Claim 1] A via contact to a diffusion region at a top surface of a substrate including a single-crystal semiconductor region, comprising:

a first layer consisting essentially of a silicide of a first metal in contact with said diffusion region at said top surface;

a dielectric region overlying said first layer, said dielectric region having an outer surface and an opening extending from said outer surface to said top surface of said substrate;

a second layer lining said opening and contacting said top surface in said opening, said second layer including a second metal lining a sidewall of said opening and a silicide of said second metal self-aligned to said top surface in said opening;

a diffusion barrier layer overlying said second layer within said opening; and

a third layer including a third metal overlying said diffusion barrier layer and filling said opening.

[Claim 2] The via contact as claimed in claim 1, wherein said first metal is selected from the group consisting of cobalt (Co), molybdenum (Mo), niobium (Nb), nickel (Ni), palladium (Pd), platinum (Pt), tantalum (Ta), titanium (Ti), vanadium (V) and tungsten (W).

[Claim 3] The via contact as claimed in claim 2, wherein said second metal is selected from the group consisting of titanium (Ti), nickel (Ni), platinum (Pt), cobalt (Co), tantalum (Ta), and tungsten (W).

[Claim 4] The via contact as claimed in claim 3, wherein said first metal and said second metal are the same.

[Claim 5] The via contact as claimed in claim 3, wherein said first metal consists essentially of cobalt and said second metal consists essentially of titanium.

[Claim 6] The via contact as claimed in claim 5, wherein said diffusion barrier layer includes a metal nitride.

[Claim 7] The via contact as claimed in claim 6, wherein said metal nitride includes titanium nitride (TiN).

[Claim 8] The via contact as claimed in claim 7, wherein said third metal includes tungsten (W).

[Claim 9] The via contact as claimed in claim 8, wherein said opening has a width of about 250 nm or less and a height-to-width aspect ratio greater than one.

[Claim 10] The via contact as claimed in claim 9, wherein said aspect ratio value is about two.

[Claim 11] A method of forming a via contact to a diffusion region in a single-crystal semiconductor region at a top surface of a substrate, comprising:

forming a first layer in contact with said diffusion region at said top surface, said layer consisting essentially of a silicide of a first metal;
forming a dielectric region overlying said first layer;
etching an opening in said dielectric region extending at least to said first layer at said top surface of said substrate;

forming a second layer lining said opening, said second layer including a second metal;
depositing a diffusion barrier layer overlying said second layer within said opening;
depositing a third layer including a third metal over said diffusion barrier layer to fill said opening; and
heating said substrate to cause said second metal to form a silicide at said top surface.

[Claim 12] The method as claimed in claim 11, wherein said first metal is selected from the group consisting of cobalt (Co), molybdenum (Mo), niobium (Nb), nickel (Ni), palladium (Pd), platinum (Pt), tantalum (Ta), titanium (Ti), vanadium (V) and tungsten (W).

[Claim 13] The method of forming a via contact as claimed in claim 12, wherein said second layer is deposited to a thickness greater than about 30 angstroms (Å) at a point of contact with said top surface.

[Claim 14] The method as claimed in claim 13, wherein said second metal is selected from the group consisting of titanium (Ti), nickel (Ni), platinum (Pt), cobalt (Co), tantalum (Ta) and tungsten (W).

[Claim 15] The method as claimed in claim 14, wherein said second metal is deposited to a thickness of about 80 angstroms (Å) or less at said point of contact with said top surface.

[Claim 16] The method as claimed in claim 14, wherein said diffusion barrier layer includes a metal nitride.

[Claim 17] The method as claimed in claim 16, wherein said metal nitride includes titanium nitride (TiN).

[Claim 18] The method as claimed in claim 17, wherein said diffusion barrier layer is deposited by chemical vapor deposition (CVD).

[Claim 19] The method as claimed in claim 18, wherein said third metal includes tungsten (W).

[Claim 20] The method as claimed in claim 19, wherein said third layer is deposited by chemical vapor deposition (CVD).